Description

Hair Detergent Compositions

Field of the Invention

The present invention relates to silicone containing hair detergent compositions which provide benefits including rich foaming upon washing the hair and give excellent conditioning effects to the hair.

Background of the Invention

Although conditioning ingredients such as silicones are usually added to hair detergents for the purpose of giving conditioning effects to the hair, their effects are not always sufficient. Another problem is that they disturb foaming of the detergents.

Summary of the Invention

In the present invention, there is thus provided a hair detergent composition comprising the following components (a), (b) and (c):

(a) an anionic surfactant,

(b) a monoalkyl glyceryl ether or monoalkenyl glyceryl ether having a C_{4-12} alkyl or alkenyl group, including mixtures thereof, and

(c) a silicone derivative having a group containing

both a hydroxy group and a nitrogen atom as a side chain thereof bonded to a silicon atom.

Detailed Description of the Invention

All references cited are hereby incorporated by reference.

The present invention relates to hair detergent compositions providing rich foaming upon shampooing and is capable of giving excellent conditioning effects to the hair.

The present inventors have found that hair detergent compositions satisfying the above-described demand are obtainable by using, in combination, an anionic surfactant, a specific glyceryl ether, and a silicone derivative having a side chain containing both a hydroxy group and a nitrogen atom.

As the anionic surfactant of Component (a), sulfate-, sulfonate- and carboxylate-type surfactants are preferred. Specific examples include alkyl sulfates, polyoxyalkylene alkyl ether sulfates, polyoxyalkylene alkenyl ether sulfates, alkyl sulfosuccinates, polyoxyalkylene alkyl sulfosuccinates, polyoxyalkylene alkylphenyl ether sulfates, and higher fatty acid salts. Among these, polyoxyalkylene alkyl ether sulfates and alkyl sulfates are preferred, with those represented by the following formula (a1) or (a2)

being particularly preferred.

$$RO(CH_2CH_2O)_nSO_3M \qquad (a1)$$

$$R'OSO_3M \qquad (a2)$$

wherein, R represents a C_{10-18} alkyl or alkenyl group, R' represents a C_{10-18} alkyl group, M represents an alkali metal, alkaline earth metal, ammonium, alkanolamine or basic amino acid, and n stands for a number of from 1 to 5 on weight average.

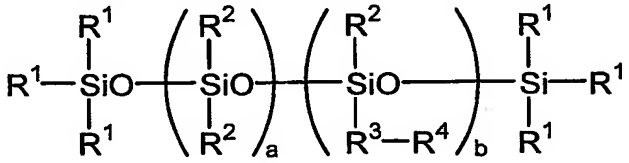
As Component (a), two or more of these anionic surfactants may be used in combination. The content of Component (a) in the hair detergent composition of the invention preferably ranges from 0.5 to 60 wt.%, more preferably from 1 to 30 wt.%, especially preferably from 8 to 20 wt.%, from the viewpoints of foaming performance, liquid state during use and detergency.

The alkyl or alkenyl group of the monoalkyl glyceryl ether or monoalkenyl glyceryl ether as Component (b) is preferably a linear or branched C_{4-10}, especially C_{8-10}, alkyl group. Specific examples include n-butyl, isobutyl, n-pentyl, 2-methylbutyl, isopentyl, n-hexyl, isohexyl, n-heptyl, n-octyl, 2-ethylhexyl, n-decyl and isodecyl groups, of which 2-ethylhexyl and isodecyl groups are especially preferred.

As Component (b), two or more of the above-described compounds may be used in combination. The content of

Component (b) in the hair detergent composition of the invention ranges preferably from 0.1 to 30 wt.%, more preferably from 0.5 to 15 wt.%, especially preferably from 1 to 10 wt.%, from the viewpoints of attaining sufficient foaming power without impairing a feeling upon use and conditioning effects.

The silicone derivative as Component (c) has, as a side chain thereof bonded to a silicon atom, a group containing both a hydroxy group and a nitrogen atom. Preferred specific examples include those represented by the following average formula (1):



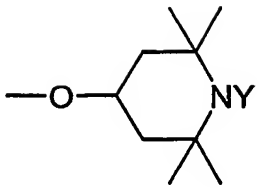
(1)

wherein, R^1 each independently represents a monovalent hydrocarbon group, a hydroxy group or an alkoxy group,

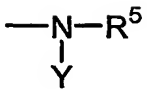
R^2 each independently represents a monovalent hydrocarbon group,

R^3 each independently represents a divalent C_{1-10} hydrocarbon group,

R^4 each independently represents a group represented by the following formula (2) or (3):



(2)



(3)

wherein, Y each independently represents a hydrogen atom or a group: $-CH_2CH(OH)-R^3-OH$ (R^3 has the same meaning as described above), R^5 each independently represents a hydrogen atom or a group $-R^3NY_2$ (Y and R^3 have the same meanings as described above), with the proviso that all the Ys do not represent a hydrogen atom simultaneously,

a stands for a number of from 25 to 1,000, and

b stands for a number of from 1 to 200.

Examples of the monovalent hydrocarbon group as R^1 include alkyl groups and aryl groups. As R^1, C_{1-3} alkyl groups (particularly, methyl group) and C_{1-15}, especially C_{10-15} alkoxy groups are preferred.

Examples of the monovalent hydrocarbon group as R^2 include C_{1-6} alkyl groups such as methyl, ethyl, propyl, butyl, pentyl and hexyl, C_{6-10} aryl groups such as phenyl, tolyl and xylyl, and C_{6-10} aralkyl groups such as benzyl and phenethyl. Among these, an alkyl group, particularly a methyl group, is preferred.

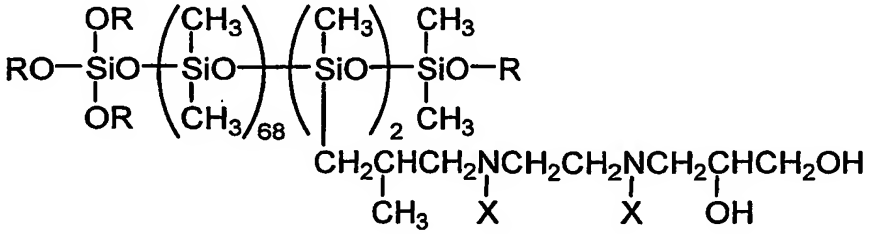
Examples of the divalent C_{1-10} hydrocarbon group as R^3 include methylene group, alkylene groups such as ethylene, trimethylene, propylene, tetramethylene, methyltrimethylene,

ethylethylene and dimethylethylene groups, and alkylene-arylene groups such as a group represented by the formula: $-(CH_2)_2-C_6H_4-$. Among these, C_{2-4} alkylene groups are preferred.

When Y represents a group: $-CH_2CH(OH)-R^3-OH$, it is preferably a 2,3-dihydroxypropyl group. As R^4, groups represented by the formula (3) are preferred, while as R^5, N-(2,3-dihydroxypropyl)aminoethyl and N,N-bis(2,3-dihydroxypropyl)aminoethyl groups are preferred.

It is preferred that a stands for a number of from 75 to 400 and b stands for a number of from 1 to 20.

The silicone derivative serving as Component (c) can be synthesized, for example, by reacting an amino-modified silicone with an epoxy functional compound such as glycidol as described in EP-0399706A2. Examples of the silicone derivative as Component (c) include compounds represented by the below-described formula, while those of commercially available products include "8500 Conditioning Agent" (CAS No. 237753-63-8; product of Dow Corning Corp).



R: $C_{13}H_{27}$ to $C_{15}H_{31}$

X: 75% of $-CH_2CH(OH)CH_2OH$ and 25% of hydrogen atom

As Component (c), two or more of the above-described derivatives may be used in combination. From the viewpoints of smoothness and softness of the hair during the period of time from shampooing to rinsing, and smoothness of the hair after drying, the content of Component (c) in the detergent composition of the invention ranges preferably from 0.05 to 4 wt.%, more preferably from 0.07 to 2 wt.%, especially preferably from 0.1 to 1.5 wt.%.

To the detergent composition of the invention, a nonionic surfactant or amphoteric surfactant may be added in order to improve foaming performance.

Examples of the nonionic surfactant include polyoxyalkylene sorbitan fatty acid esters, polyoxyalkylene sorbit fatty acid esters, polyoxyalkylene glycerin fatty acid esters, polyoxyalkylene fatty acid esters, polyoxyalkylene alkyl ethers, polyoxyalkylene alkyl phenyl ethers, polyoxyalkylene (hydrogenated) castor oils, sucrose fatty acid esters, polyglycerin alkyl ethers, polyglycerin fatty acid esters, fatty acid alkanolamides and alkyl glycosides. Among these, alkyl glycosides, polyoxyalkylene alkyl ethers, polyoxyalkylene (C_8 to C_{20}) fatty acid esters, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene hydrogenated castor oils, and fatty acid alkanolamides are preferred. As fatty acid alkanolamides, those having a C_{8-18}, especially C_{10-16}, acyl group are preferred. The fatty

acid alkanolamides may be either monoalkanolamides or dialkanolamides, and those having a C_{2-3} hydroxyalkyl group are preferred. Examples include oleic diethanolamide, palm kernel fatty acid diethanolamide, coconut fatty acid diethanolamide, lauric diethanolamide, polyoxyethylene coconut fatty acid monoethanolamide, coconut fatty acid monoethanolamide, lauric isopropanolamide and lauric monoethanolamide.

As the amphoteric surfactant, betaine surfactants are usable. Among these, alkyldimethylaminoacetic betaines and fatty acid amidopropyl betaines are more preferred, with fatty acid amidopropyl betaines being particularly preferred. The fatty acid amidopropyl betaines preferably have a C_{8-18}, especially C_{10-16}, acyl group. Among these, lauramidopropyl betaine, palm kernel amidopropyl betaine and cocamidopropyl betaine are especially preferred.

To the detergent composition of the present invention, a conditioning component selected from cationic polymers, cationic surfactants, silicones other than Component (c) and oils can be added in order to improve the finish after drying.

Examples of the cationic polymer include cationized cellulose derivatives, cationic starch, cationized guar gum derivatives, homopolymers of diallyl quaternary ammonium salts, diallyl quaternary ammonium salt/acrylamide

copolymers, quaternized polyvinylpyrrolidone derivatives, polyglycol polyamine condensates, vinylimidazolium trichloride/vinylpyrrolidone copolymers, hydroxyethyl cellulose/dimethyldiallylammonium chloride copolymers, vinylpyrrolidone/quaternized dimethylaminoethyl methacrylate copolymers, polyvinylpyrrolidone/alkylamino acrylate copolymers, polyvinylpyrrolidone/alkylamino acrylate/vinylcaprolactam copolymers, vinylpyrrolidone/methacrylamidopropyl trimethylammonium chloride copolymers, alkylacrylamide/acrylate/alkylaminoalkylacrylamide/polyethylene glycol methacrylate copolymers, an adipic acid/dimethylaminohydroxypropyl ethylenetriamine copolymer ("Cartaretin", product of Sandoz/USA), and cationic polymers as described in Japanese Patent Laid-Open Nos. 139734/1978 and 36407/1985. Among these, cationized cellulose derivatives and cationized guar gum derivatives are particularly preferred.

Examples of the cationic surfactant include lauryl trimethyl ammonium chloride, cetyl trimethyl ammonium chloride, cetyl trimethyl ammonium bromide, stearyl trimethyl ammonium chloride, stearyl trimethyl ammonium bromide, lauryl trimethyl ammonium bromide, behenyl trimethyl ammonium chloride, dialkyl dimethyl ammonium chloride, dicetyl dimethyl ammonium chloride, distearyl

dimethyl ammonium chloride, dicocoyl dimethyl ammonium chloride, myristyl dimethyl benzyl ammonium chloride, stearyl dimethyl benzyl ammonium chloride, lanolin fatty acid amidopropyl ethyldimethyl ammonium ethyl sulfate, lanolin fatty acid amidoethyl triethyl ammonium ethyl sulfate, stearyl amidopropyl dimethylamine (and salts thereof), stearyl amidoethyl diethylamine (and salts thereof), stearoxy propyl dimethylamine (and salts thereof), stearoxy propyl trimethyl ammonium chloride, lanolin fatty acid amidopropyl triethyl ammonium ethyl sulfate, lanolin fatty acid amidoethyl trimethyl ammonium methyl sulfate, lanolin fatty acid amidopropyl ethyldimethyl ammonium methyl sulfate, isoalkanoic acid (C_{14-20}) amidopropyl ethyldimethyl ammonium ethyl sulfate, isoalkanoic acid (C_{18-22}) amidopropyl ethyldimethyl ammonium ethyl sulfate, isostearic acid amidopropyl ethyldimethyl ammonium ethyl sulfate, isononanoic acid amidopropyl ethyldimethyl ammonium ethyl sulfate and alkyl trimethyl ammonium saccharine.

As the silicones other than Component (c), the following compounds can be given as examples.

(Silicones-1) Dimethylpolysiloxane

Examples include compounds represented by the following formula:

$$(Me)_3SiO-[(Me)_2SiO]_d-Si(Me)_3$$

wherein, Me represents a methyl group and d stands for a number of from 3 to 2,000.

(Sililcones-2) Amino-modified silicone

Various amino-modified silicones are usable, but those having an average molecular weight of from about 3,000 to 100,000 and described under the name of Amodimethicone in the CTFA Dictionary (Cosmetic Ingredient Dictionary, USA), third edition are particularly preferred. This amino-modified silicone is preferably employed in the form of an aqueous emulsion and "SM 8704C" (product of Dow Corning Toray Silicone), "DC 929" (product of Dow Corning), etc. are the commercially available products of the aqueous emulsion.

(Silicones-3) The other silicones

In addition to the above-described silicones, usable are polyether-modified silicones, methylphenyl polysiloxane, fatty acid-modified silicones, alcohol-modified silicones, alkoxy-modified silicones, epoxy-modified silicones, fluorine-modified silicones, cyclic silicones, and alkyl-modified silicones.

The term "oils" to be used herein as the conditioning component means an oily substance other than silicones and examples include hydrocarbons such as squalene, squalane, liquid paraffin, liquid isoparaffin and cycloparaffin; glycerides such as castor oil, cacao oil, mink oil, avocado

oil and olive oil; waxes such as beeswax, spermaceti, lanolin and carnauba wax; alcohols such as cetyl alcohol, oleyl alcohol, stearyl alcohol, isostearyl alcohol, 2-octyldodecanol and glycerin; esters such as isopropyl palmitate, isopropyl myristate, octyldodecyl myristate, hexyl laurate, cetyl lactate, propylene glycol monostearate, oleyl oleate, hexadecyl 2-ethylhexanoate, isononyl isononanoate, and tridecyl isononanoate; higher fatty acids such as capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, behenic acid, oleic acid, coconut fatty acid, isostearic acid and isopalmitic acid; and isostearyl glyceryl ether and polyoxypropylene butyl ether. Among these, esters, particularly hexadecyl 2-ethylhexanoate, isononyl isononanoate and isopropyl palmitate, are particularly preferred.

As the conditioning component, two or more of these compounds may be used in combination. Its content in the hair detergent composition of the invention ranges preferably from 0.05 to 10 wt.%, more preferably from 0.07 to 5 wt.%, especially preferably from 0.1 to 2 wt.% from the viewpoints of lubrication of foams, and smoothness during the period of time from shampooing to rinsing.

In addition to the above-described components, components conventionally used for a hair detergent can be incorporated in the hair detergent composition of the

present invention, depending on the purpose. Such optional components include antidandruff, vitamins, bactericides, anti-inflammatory agents, antiseptics, chelating agents, humectants such as sorbitol and pantenol, colorants such as dyes and pigments, viscosity regulators such as hydroxyethyl cellulose, methyl cellulose, polyethylene glycol and clay minerals; pH regulators such as citric acid and potassium hydroxide; vegetable extracts; pearling agents; perfumes; coloring matters; ultraviolet absorbers; antioxidants; and the other components as described in the ENCYCLOPEDIA OF SHAMPOO INGREDIENTS (MICELLE PRESS).

Although the form of the hair detergent of the invention can be selected as needed from liquid, powder, gel and granule, a liquid type using water or a lower alcohol, especially water, as a solvent is preferred.

The hair detergent of the invention is preferably used as a shampoo composition.

The hair detergent of the invention preferably has a pH of from 3 to 10, especially preferably from 3 to 7 when diluted to 20 times the weight with water.

-Examples-

The following examples further describe and demonstrate embodiments of the present invention. The examples are given solely for the purpose of illustration

and are not to be construed as limitations of the present invention.

Example 1 and Comparative Examples 1 to 3

Shampoo compositions as shown in Table 1 were prepared and they were organoleptically evaluated.

(Hair washing method)

After the hair was moistened sufficiently, 5 g or 10 g (5 g for medium-length hair and 10 g for long hair) of the shampoo composition was applied to the hair and the hair was washed therewith. The hair was then rinsed well with water, followed by sufficient drying with hot air from a dryer.

(Organoleptic Evaluation)

The shampoo compositions were evaluated by a panel of 10 experts based on the criteria described below and ranked based on the average score.

Evaluation criteria

(1) Foaming performance

4: Excellent foaming

3: Good foaming

2: Average foaming

1: Little foaming

0: No foaming

(2) Softness of the hair during foaming

4: Very soft

3: Soft

2: Slightly soft

1: Not so soft

0: Rigid

(3) Smoothness of the hair during rinsing and after drying

4: Very smooth

3: Smooth

2: Slightly smooth

1: Not so smooth

0: Not smooth

Rank

A: an average score of not less than 3.5

B: an average score of not less than 2.5 but less than 3.5

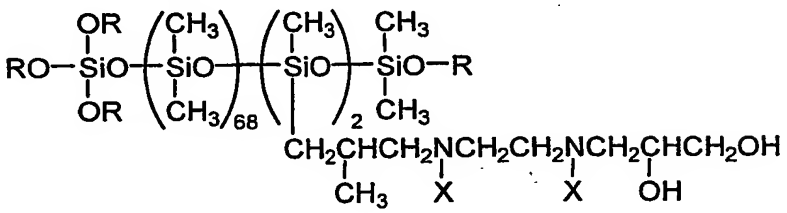
C: an average score of not less than 1.5 but less than 2.5

D: an average score less than 1.5

Table 1

Composition (wt.%)		Examples	Comparative Examples		
		1	1	2	3
(a)	Sodium polyoxyethylene (2) lauryl ether sulfate	10.0	10.0	10.0	10.0
(b)	2-Ethylhexyl glyceryl ether	2.0	2.0	-	2.0
(c)	Silicone derivative *	0.5	-	0.5	-
Others	Amino-modified silicone ("KT1989", product of GE Toshiba Silicones)	-	-	-	0.5
	Cocamidopropyl betaine	3.0	3.0	3.0	3.0
	Cocamide MEA	-	-	2.0	-
	Ethylene glycol distearyl ester	1.0	1.0	1.0	1.0
	Cationized cellulose ("UCare Polymer JR-400", product of Amerchol)	0.5	0.5	0.5	0.5
	Sodium chloride	0.5	0.5	0.5	0.5
	Perfume	Trace	Trace	Trace	Trace
	Citric acid	q.s.	q.s.	q.s.	q.s.
	Purified water	Balance	Balance	Balance	Balance
pH (after diluted to 20 times the weight)		6.0	6.0	6.0	6.0
Evaluation	Foaming performance	A	A	C	B
	Softness of hair during foaming	A	C	B	B
	Smoothness of hair during rinsing	A	C	B	D
	Smoothness of hair after drying	A	C	B	C

*silicone derivative:



R: $C_{13}H_{27}$ to $C_{15}H_{31}$

X: 75% of $-CH_2CH(OH)CH_2OH$ and 25% of hydrogen atom

Example 2: Conditioning shampoo

	(wt.%)
Sodium polyoxyethylene (2) lauryl ether sulfate	11.0
Isodecyl glyceryl ether	1.5
Silicone derivative *1	1.0
Cocamidopropyl betaine	3.0
Ethylene glycol distearyl ester	1.0

Cationized guar gum ("Jaguar C-13S", product of RHODIA)	0.4
Sodium chloride	1.0
Polypropylene glycol (Mw=400)	1.0
Malic acid	1.0
Perfume	trace
Aqueous solution of sodium hydroxide	q.s.
Purified water	Balance

*1: sold from Dow Corning under the name of "8500 CONDITIONING AGENT". It contains, as an effective ingredient, 60 wt.% of a silicone derivative (CAS No. 237753-63-8) having a group containing both a hydroxy group and a nitrogen atom as a side chain.

It has been found that the shampoo thus obtained (having pH 3.7 when diluted to 20 times the weight) had excellent foaming performance and at the same time had high hair conditioning effects.

Example 3: Conditioning shampoo

	(wt.%)
Sodium polyoxyethylene (2) lauryl ether sulfate	8.0
Sodium lauryl sulfate	5.0
Isodecyl glyceryl ether	1.5
Silicone derivative *1	0.5
Dimethyl polysiloxane (viscosity: 100,000 mPa·s)	0.3

Cocamide MEA	1.0
Myristyl alcohol	1.0
Cetanol	0.5
Glycerin	1.0
Ethylene glycol distearyl ester	1.0
Cationized cellulose ("UCare Polymer JR-30M", product of Amerchol)	0.5
Sodium chloride	0.5
Benzyloxy ethanol	1.0
Lactic acid	1.0
Perfume	trace
Aqueous solution of sodium hydroxide	q.s.
Purified water	Balance

*1: sold from Dow Corning under the name of "8500 CONDITIONING AGENT". It contains, as an effective ingredient, 60 wt.% of a silicone derivative (CAS No. 237753-63-8) having a group containing both a hydroxy group and a nitrogen atom as a side chain.

It has been found that the shampoo thus obtained (having a pH of 3.9 when diluted to 20 times the weight) had an excellent foaming performance, and at the same time had high hair conditioning effects.